

C. K. FONDRAITYEV.

THESES TO THE REPORT  
"ON SOME PRELIMINARY RESULTS OF SEISMOGLACIOLOGICAL  
INVESTIGATIONS ON THE ANTARCTIC CONTINENT.

From 1956 till 1958 the seismic group of the Second Complex Antarctic Expedition composed of four men carried out seismic investigations on the Antarctic Continent with the aim of determining the thickness of the glacier and studying physical and mechanical properties of ice.

Two seismic stations were used with the frequency response having the maximum in the frequency range from 20 c.p.s. to 150 c.p.s. Filters used had the following frequency bands: for the registration of reflected waves they were from 85 to 150 c.p.s. and from 35 to 60 c.p.s.; for the registration of refracted waves - from 20 to 60 c.p.s. and from 20 to 150 c.p.s., and for the study of the frequency response of various types of waves - from 20 to 150 c.p.s. Shot holes were bored with the help of a boring machine and by hand. The holes were from 3 to 15 m deep.

Depths were determined in the main along the profile Mirny-Pionerskaya which was 375 km long. The most detailed study was made of the first 60 km of the profile (continuous profiles shot by the method of reflected waves and the correlation method of refracted waves in the interval of 0 to 5 km and in the region of the 50-th kilometre, and the sounding by the method of reflected waves with the intervals of 1 to 3.5 km).

At the distance of 60 to 375 km of the profile the sounding by the method of reflected waves with the intervals of 10 to 25 km were mainly carried out. Reliable results are obtained up to the distance of 175 km. In more distant regions it is rather difficult or even utterly impossible to distinguish reflected waves. In the region of Pionerskaya only the order of the glacier's thickness value was determined using the data of the correlation method of refracted waves. Depths were measured also on the Drygalski island (6 points), the Masson island (1 point) on the transverse profile from the Helén glacier to

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Mt. Gauss (10 points), in the region of Mirny (19 points) and in a number of shore regions. The total number of points where depths were measured is 93. In some regions the thickness of the upper firn-snow layer was determined. Material is obtained which permits us to determine the velocity of the propagation of waves in upper layers, in the whole glacier and in underlying rocks. Special observations were conducted to study the peculiar features of various types of waves and to interpret their nature.

The elementary reading and preliminary interpretation of the material obtained are made.

In the region of the investigation first longitudinal refracted waves, transverse, surface, reflected and deep refracted waves are recorded.

Among the first refracted waves one can distinguish waves propagating in the upper firn-snow layer and in surface ice layers under this layer. The boundary velocities of waves propagating in surface ice layers increase from 3700 m/sec to 3840 m/sec farther inland. Multiple refracted waves of great multiplicity (up to 15) are recorded.

In the shore regions a transverse refracted wave similar to the first longitudinal wave is distinguished on the records. In the central regions this wave is absent and at the time of transverse waves' arrival a whole group of waves characterized by quasi-dispersion is recognized.

Surface waves are recorded in all the regions of investigation. In case of the observations on open ice they dominate, have clear first arrivals near the shot point and are characterized by a non-dispersed appearance on records. In the regions with the upper firn-snow surface waves are liable to dispersion, the quasi-dispersion of these waves is most fully displayed in the central regions.

In the shore regions a whole group of reflected waves is clearly distinguished on records. The first wave of this group is not recognized everywhere. It is of small intensity and has rather high visible trace frequency (from 100 to 150 c.p.s.). It is most likely to be a reflexion from the surface of the layer

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containing morainic material. The second wave seems to be the reflexion from the base surface. It is of greater intensity than the first one, is clearly distinguished in all the shore regions and sometimes is traced at distances corresponding to the angle of waves' incidence less or greater than critical. The nature of the succeeding reflected waves characterized by small trace intervals is not clear as yet. In the central regions (beginning with the 175-th km from the shore) it is rather difficult or even impossible to distinguish reflected waves due to great irregular and regular (transverse and surface waves) background.

In two regions (at the distance of 0 to 5 km and 50 km of the profile) clear records of the wave refracted in the base are obtained. In some intervals it is distinguished within the region of the second arrivals beginning from the initial point, which would probably permit to identify the refracted wave with one of the reflected waves. In a small profile interval in the region of Pionerskaya a unreliable deep refracted wave is distinguished. It is noticed that a smaller part of the shot energy is spent on deep waves in this region than in the shore regions.

The fact that the reflected waves are not distinguished and the refracted waves are of small intensity in the central regions is accounted for by the structure of the upper firn-snow layer. It was concluded that the most effective method of eliminating the background is the deepening of shot-holes to the depth of no less than 20 to 30 m. In one region (the 50-th kilometre) the travel-time curves of reflected waves gave the effective velocity equal to  $3760 \pm 100$  m/sec. The average velocities in the upper layer (2700 m/sec to 3100 m/sec) and in the ice (3700 m/sec to 3840 m/sec) are obtained using the data of refracted waves' travel-time curves. The values of the interface velocity in rocks along the profile from 0 to 5 km (5600 m/sec) and at the 50-th kilometre (5830 m/sec) indicate that in these regions the rocks are similar to those in Mirny.

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Seismic data were used for drawing the cross-section of the glacier along the profile Mirny-Pionerskaya; the thickness of the glacial cap gradually increases away from the shore inland (from 150 m and approximately to 2400 m). Up to the 200-th kilometre of the profile the glacier's bed has the relief characteristic for the shallow sea with islands. The absolute altitudes above the sea level of the bed in this region range from -475 m to +180 m. In the interval of 200 to 275 km an upland with the maximum heights of up to +700 m is found. Farther south a new lowering of the underglacial bed is being traced. The results of the determination of thickness on the Drygalski island have shown that the base of this island is situated below the sea-level (30-60 m). The Masson island has a base of rocks with the absolute altitude of + 70 m.